Remarks

Claim 41 has been amended as shown above. Antecedent basis for this amendment can be found in the written description at, e.g., page 7, lines 4 – 23. Following entry of this amendment claims 41 – 50 will be pending in this application. Reconsideration of the rejections is requested in view of the following remarks.

Rejection of claims 41 – 45 and 47 – 49

Claims 41 – 45 and 47 – 49 were rejected under 35 USC §103(a) as being unpatentable over U.S. Patent No. 5,464,667 (Köhler et al.) in view of U.S. Patent No. 4,954,371 (Yializis). Köhler et al. discloses a jet plasma coating apparatus that employs a feed gas **20**, a carrier gas **22**, a cathode system **40** and an adjustable anode **60** to produce carbon-rich coatings on a substrate **75**:

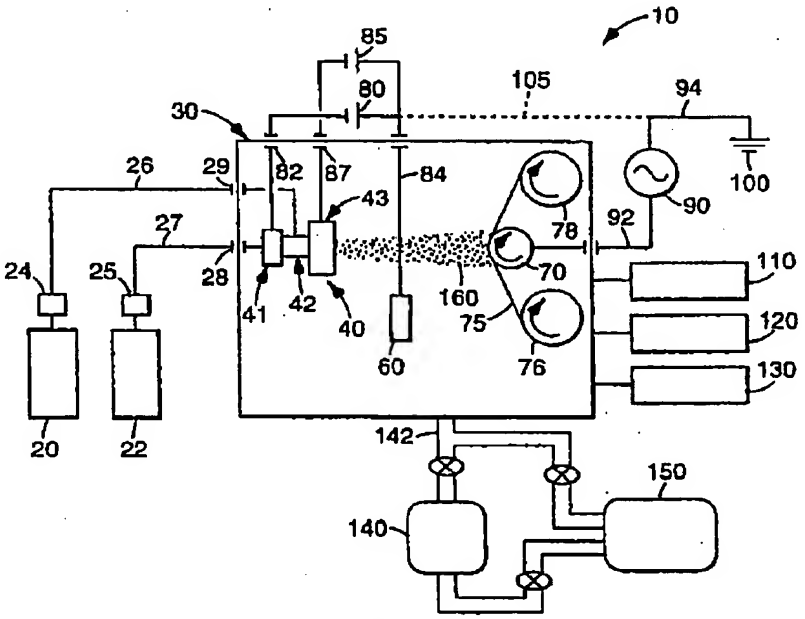


Fig. 1

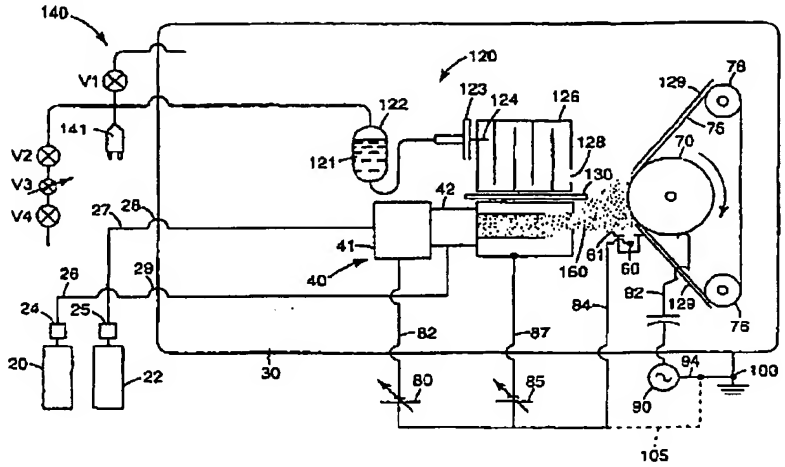
Applicants have developed an improvement in the Köhler et al. apparatus, which itself is an improvement upon prior plasma enhanced chemical vapor deposition apparatuses. In the words of applicants' written description:

"In general, high density coatings (e.g., diamond-like carbon, jet plasma carbon) are prepared by plasma enhanced chemical vapor deposition (PECVD), which utilize negatively biased substrates in contact with radio frequency powered cathodes. Typically, the system provides ion bombardment of the fragmented species of feed gas (e.g., acetylene) and ions of carrier gas (e.g., argon) onto the substrate to cause atomic arrangement/rearrangement of the coating being formed to a dense structure. Simultaneously, the cathode is utilized for extensive fragmentation of the feed gas, as described in U.S. Patent No. 4,382,100 (Holland). Because the two process parameters, namely the extensive fragmentation and the ion attraction cannot be controlled independently, conventional PECVD methods are limited and unfavorable for high rate deposition. This limitation has been overcome in U.S. Patent No. 5,464,667 (Kohler et al.), which teaches the independent use of the hollow cathode for feed gas fragmentation and a second cathode to bias the film substrate to deposit these fragments.

"The present invention includes modifications of the systems described in U.S. Patent Nos. 5,286,534 (Kohler et al.) and 5,464,667 (Kohler et al.), which allow for the deposition of dense coatings without extensive fragmentation of the starting material. Significantly, using the process and system of the present invention, high molecular weight organic starting materials can be converted into dense coatings without extensive fragmentation and without a significant loss of physical and chemical properties inherent to the starting material. These differences between the coatings of the present invention and coatings produced by conventional methods are exemplified by Examples 1, 3, and 4 and Comparative Example A discussed in greater detail below." (page 11, lines 3 – 26)

The referenced Comparative Example A shows, for example, that greater density and hardness and lower water vapor permeability can be obtained when the Köhler et al. apparatus is modified by adding an oil delivery system that provides a vaporized organic material stream positioned relative to the cathode system such that the vaporized organic material and the plasma interact prior to, or upon contact with, the substrate. For example, in one such

modified apparatus a plasma stream **160** containing gaseous material **20** and a vapor stream made from oil **121** are allowed to interact in the gap between divider **130** and substrate **75**:



As mentioned in applicants' written description, interaction between the plasma and vaporized organic material can provide several advantages:

> *"the interaction of the vaporized organic material and the plasma provides a reactive form of the organic material (e.g., loss of methyl group from silicone) to enable densification of the material upon formation of the coating, as a result of polymerization and/or crosslinking, for example. Thus, the method of the present invention provides the means of high rate deposition, approaching the condensation rate of the vaporized organic material; it also provides the means of preparing coatings where the physical and chemical composition and structure of the precursor is maintained to a high degree."* (page 10, lines 8 – 15).

Note however that interaction of the plasma and vaporized organic material can also cause polymerization of the vaporized organic material, and that increased interaction can increase the degree of polymerization. Such increased interaction may be brought about for example by increasing the distance between divider **130** and substrate **75**, see e.g., Examples 7 and 8 at pages 47 – 48.

The Office Action acknowledges that *"Kohler fails to teach an oil delivery system for providing a vaporized organic material"*, but proposes to modify Köhler et al. as follows:

"Referring to Figures 5 and 6 and column 5 , lines 3-10,36-48, col. 8, lines 67 - col. 9, lines 10, and column 11, lines 29-36, Yializis teaches an apparatus for coating a substrate using an oil delivery system 110, 261. The oil delivery system includes an atomizer 115 for forming droplets, a vaporization chamber 116, and a nozzle structure 118 for delivering the vapor to the chamber 123. Various materials are selected for the oil delivery system such as natural oils or silicone. By using a vaporized organic precursor in the apparatus, an organic material layer is deposited on the substrate. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to art to provide an oil delivery system as taught by Yializis as the feed gas source in Kohler in order to form an organic material layer on a substrate."

Although not mentioned in the Office Action, it should be noted that Yializis does not involve plasma enhanced chemical vapor deposition or the formation of carbon-rich coatings, and that Yializis does not have a plasma generation apparatus, nor does it have an anode or a cathode system as set forth in claim 41. Yializis describes an apparatus for forming alternating polymer/metal layers on a substrate, e.g. for making film capacitors:

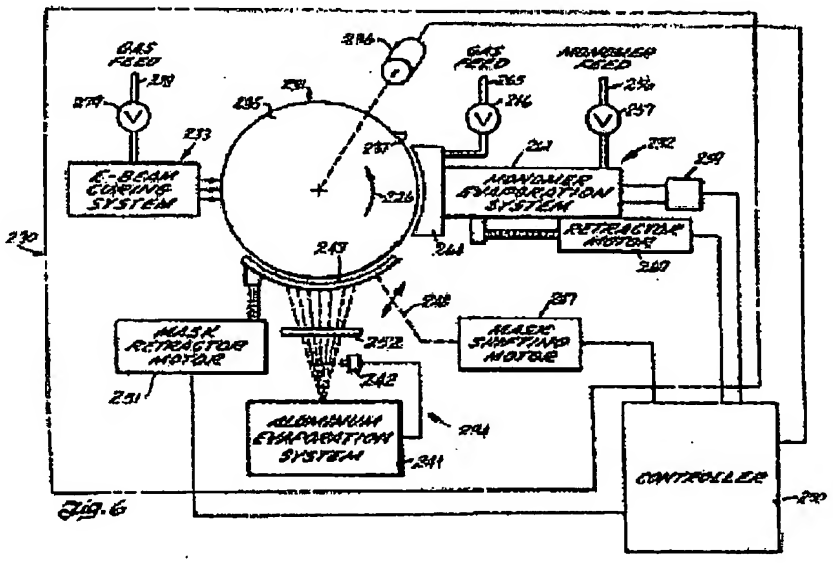


Fig. 6

The Office Action proposes to use Yializis' monomer evaporation system "*as the feed gas source in Kohler*". This proposed modification would however directly contravene Yializis' own requirements. The proposed modification would allow Yializis' vaporized monomer

stream to interact with Köhler et al.'s plasma along the entire plasma path length. As shown by applicants (see e.g., Examples 7 and 8 as mentioned above and page 9, line 24 through page 10, line 15), such interaction could cause polymerization of the monomer before or upon deposition. Yializis stresses however that only a monomeric film should be deposited:

> *"From the foregoing, it is evident that in order to achieve the results which are desired in accordance with the aforementioned application Ser. No. 620,647, a method for depositing a thin uniform* ***monomeric*** *layer on the desired substrate is* ***absolutely essential.*** *"* (col. 2, lines 50 – 54, emphasis added).

Also:

> *"Thus, especially in view of the process disclosed in the aforementioned application, Ser. No. 620,647, now abandoned, there exists a need for a method by which polymerizable and/or cross-linkable materials may be uniformly deposited upon a desired substrate in a controlled manner such that said materials may be* ***subsequently*** *cured to form a desired polymeric layer on said substrate."* (col. 3, lines 35 – 42, emphasis added)

The Office Action does not provide a proper basis for ignoring Yializis' above-mentioned requirements, and does not provide a proper motivation for combining Yializis and Köhler et al. in the first instance. Both references involve coating devices, but so do hundreds or thousands of other references. "The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination", see MPEP §2143.01. No proper basis has been given for doing so.

Moreover even if the proposed modification were made, the resulting combination would not provide a plasma stream from a first source and an oil delivery system for providing vaporized organic material in another stream as recited in amended claim 41.

Applicants accordingly request withdrawal of the 35 USC §103(a) rejection of claims 41 – 45 and 47 - 49 as being unpatentable over Köhler et al. in view of Yializis.

Rejection of claims 46 and 50

Claims 46 and 50 were rejected under 35 USC §103(a) as being unpatentable over Köhler et al. in view of Yializis and U.S. Patent No. 5,342,660 (Cann et al.). The Office Action asserts that:

> *"Referring to Figure 1 and column 3, lines 31-35, Cann teaches magnets 217 surrounding the plasma jet apparatus 215. The magnets are used to accelerate and focus the plasma towards the deposition region. Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to surround the point source's tube of Kohler in view of Yializis with a magnet as taught by Cann in order for the plasma to be accelerated and focused towards the substrate."*

The deficiencies of Köhler et al. and Yializis are discussed above and are relied on to distinguish claim 46 from the proposed combination of Köhler et al., Yializis and Cann et al. As to claim 50, Cann et al. does not position a leading edge of a tube in line with the center of a magnet. In the words of applicants' written description:

> *"Using this particular configuration, a stable plasma can be sustained and contained in region 414 defined by extensions 416 of the cylinder 402. This configuration of the cylinder 402 along with the placement of the magnet 408 concentrates the plasma such that it extends as a point source into the vacuum in a cone shape configuration. It is important to note that the strongest plasma is generated if the leading edge 405 of the ceramic tube 404 is directly in line with the center (with respect to its width) of the circular magnet 408."*

The Office Action relies on Cann et al. to add a surrounding magnet to Köhler et al.'s source tube. However, the Office Action does not indicate where in Köhler et al., Yializis or Cann et al. there is any proper motivation to position a tube as recited in claim 50. Applicants accordingly request withdrawal of the 35 USC §103(a) rejection of claims 46 and 50 as being unpatentable over Köhler et al. in view of Yializis and Cann et al.

Double Patenting Rejection of claims 41 – 44 and 47 - 49

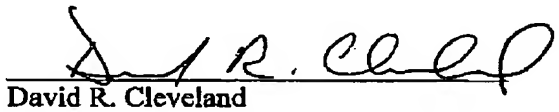
Claims 41 – 44 and 47 – 49 were rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 15, 16, 18 and 19 of

Köhler et al. in view of Yializis. This rejection should be withdrawn for the reasons already recited above with respect to the 35 USC §103(a) rejection of claims 41 – 45 and 47 – 49. Applicants accordingly request withdrawal of the double patenting rejection of claims 41 – 44 and 47 – 49 as being unpatentable over claims 15, 16, 18 and 19 of Köhler et al. in view of Yializis.

Conclusion

Applicants have made an earnest effort to resolve all issues. The cited references do not provide an apparatus having the features recited in rejected claims 41 – 50. The double patenting rejection should be withdrawn. Issuance of a Notice of Allowability is requested. If any questions remain unresolved, the Examiner is encouraged to telephone the undersigned attorney at 612-331-7412.

Respectfully submitted on behalf of 3M Innovative Properties Company,



December 30, 2003

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